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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/863,861	05/23/2001	Vetle Vinje	RR-482	9924

20427 7590 08/12/2003

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EXAMINER
LE, TOAN M

ART UNIT	PAPER NUMBER
2863	

DATE MAILED: 08/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/863,861	Applicant(s) VINJE, VETLE	
	Examiner Toan M Le	Art Unit 2863	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2001* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,7 and 13-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 7, and 13-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 7, and 13-29 are rejected under 35 U.S.C. 102(b) as being anticipated by "Multiple Weights in Diffraction Stack Migration", Tygel et al. (Referring hereafter Tygel et al.).

Referring to claims 1, 7, and 23, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground (abstract), the method comprising: a) migrating to depth recorded traces in a survey by Pre-Stack Depth Migration (PSDM), using shot/receiver pairs, thereby achieving a real depth migrated seismic cube $P_{obs}(x)$ which is a function of the recorded traces that have each been given a weight $w_i(x)$ (page 1820, Introduction section: lines 1-8); b) interpreting $P_{obs}(x)$ to find the spatial positions of the reflectors in the subsurface, and based on these reflectors and the seismic velocities, a depth model is established in the computer, and one of the reflectors in the depth model is chosen to be the target reflector (Abstract; pages 1821-1822, section Diffraction-Stack Migration Theory: lines 1-20 and first half of first column on page 1822, equation 1; figures 1-2 and 4-5); c) computing synthetic traces from the target reflector for all shot/receiver pairs in the survey that

was used in a) (page 1825, Synthetic Example in 2-D section: lines 1-30; figures 4-5; d) setting the RC of the target reflector in the depth model to an essentially constant value when the synthetic traces are computed (figures 5-6); e) doing a local PSDM of the synthetic traces in a band around the target reflector to obtain a model PSDM cube $P_{Mod}(x)$ (page 1825, second half; page 1826, first half; figures 5-6); and f) measuring the amplitudes along target reflector on the real PSDM cube $P_{obs}(x)$, dividing these measurements by the corresponding measurements from the modeled PSDM cube $P_{Mod}(x)$, thereby obtaining an estimate of the angle dependent RC with corresponding reflection angle and weight function (pages 1826-1827, Conclusions section: lines 1-37; figures 4-6 and 11; equations 3 and 5).

As to claims 13, 18, and 24, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein the RC in d) is set to 1.0 in the calculation of the synthetic traces (page 1825, second paragraph).

Referring to claims 14, 19, and 25, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein the same weights $w_i(x)$ in the PSDM in a) are used in the local PSDM in e) (page 1823, Three Fundamental Weights section: first paragraph; and page 1825, second paragraph; pages 1826-1827, Conclusions section: lines 1-37).

As to claims 15, 20, and 26, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the

Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein "square" method or "norm" method is used for measuring the amplitudes in f) (equations 1, 3, and 5).

Referring to claims 16, 21, and 27, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein the process in a)-f) is repeated for points along the target reflector to create a map of the RC for the target reflector (page 1825, section Synthetic Example in 2-D; figures 4-6 and 11).

As to claims 17, 22, and 28, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein the synthetic traces in c) are computed by ray tracing (figures 6-7).

Referring to claim 29, Tygel et al. disclose a method and a computer usable medium having computer readable program code incorporated into the method for finding the Reflection Coefficient (RC) of reflectors in the subsurface of the ground, wherein a map is produced by multidimensional plotting (figures 1-2 and 11).

Remarks:

Response to Arguments

Applicant's arguments filed 5/27/03 have been fully considered but they are not persuasive.

Referring to claims 1, 7, and 23, Applicant argues that "$P_{Obs}(x)$ is interpreted so that the special positions of the reflectors in the subsurface are found. Based on these reflectors and seismic velocities used in the PSDM in step (a) a computerized depth model is constructed. One

of the surfaces in the model is chosen as a target reflector. In contrast, in Tygel et al., the positions of explicit reflectors are not found by interpretation, but rather by finding points M=R that give finite values of c(M) in equation 5.

Tygel et al. disclose in the Abstract, "Three-dimensional (3-D) prestack diffraction-stack migration methods (often called Kirchhoff migration/inversion) play a fundamental role in seismic imaging. In addition to estimating the location of arbitrarily curved reflectors and the angle-dependent reflection coefficients upon them..."

Tygel et al. further disclose a computerized depth model is constructed based on the reflectors and seismic velocities used in the PSDM in step (a) (equation 1; figures 1-4 and 6). One of the surfaces in the model is chosen as a target reflector (page 1827, first column, lines 21-30).

Applicant further argues that "Steps (c) and (d) of claims 1, 7, and 23 deal with the computation of synthetic traces from the target reflector for all shot/receiver pairs. The reflection coefficient of the target reflector is then set in the depth model to essentially constant value when the synthetic traces are computed. In contrast, Tygel calculates the ray from the source positions on the surface to a specular reflection point M=R to the receiver." and "step (e) uses a dynamic approach to perform a pre-stack depth migration of the traces from the ray tracing using a two way travel time approximation computed by the ray tracing. The ray tracing tracers are then computed setting the reflection coefficient of the target reflector to unity. The source pulse or another suitable pulses is then used in generating the ray tracing traces. In contrast, Tygel et al. derives weight factors under the assumption of a stationary phase as in equation B3 in Appendix B on page 1830. The dynamic approach of the claimed invention is in

contrast to the static approach of Tygel et al. which is also a fundamental difference between applicant's claimed invention and Tygel et al.".

Applicant additionally argues that "Step (f) of claims 1, 7, and 23 measure the amplitude along the target reflector from the real PSDM cube. These measurements are divided by the corresponding measurements of the model PSDM cube to obtain an estimate of the angle dependent reflection coefficient with corresponding reflection angle and weight function. In contrast, Tygel et al. corrects the migration result V_1 (see page 1824 in Tygel et al.) in the reflection point R with the weight derived from the weight factors already discussed in the previous step." and "the reflection angle is found corresponding to the estimate of the reflection coefficient by taking the weighted average of all rays contributing to each estimate along the reflector. In contrast, Tygel et al. finds the reflection angle corresponding to the corrected amplitude point found in point R by using the reflection angle of the specular ray."

Tygel et al. disclose on page 1827, first column, lines 21-30, "In particular, amplitude-preserving migrations that use a weighted diffraction stack (Kirchhoff migration) to determine reflection coefficients can be performed more economically. After a vector-weighted diffraction stack has been done, only one weighted factor per (known) specular ray needs to be computed. The number of rays to which dynamic ray tracing is to be applied is thus drastically reduced. The result of the unweighted diffraction stack is then multiplied with this weight factor that yields the reflection coefficient at the corresponding reflection point."

Conclusion

THIS ACTION IS MADE FINAL.

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toan M Le whose telephone number is (703) 305-4016. The examiner can normally be reached on Monday through Friday from 9:00 A.M. to 5:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Barlow can be reached on (703) 308-3126. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0655.

Toan Le

August 4, 2003

John Barlow
Supervisory Patent Examiner
Technology Center 2800